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## The importance of team functioning to natural resource planning outcomes

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## ABSTRACT

In its recent history, the U.S. Forest Service is among many federal land management agencies struggling with questions concerning why its planning procedures are sometimes inefficient, perform poorly in the eyes of the public, and fail to deliver outputs that advance agency mission. By examining a representative sample of National Environmental Policy Act (NEPA) processes conducted by the agency between 2007 and 2009, we provide new insights into what drives outcomes in these planning processes. We examined team leaders' perceptions of the following outcomes: achievement of agency goals and NEPA mandates, process efficiency, public relations, and team outcomes. The most consistently important predictors of positive outcomes were team harmony and a clearly empowered team leader. Other factors, such as perceptions of the use of best science, a clear and unambiguous purpose and need, team turnover (personnel changes during the process), extra-agency engagement, and intra-agency relations, were also important, but played a less consistent role. The findings suggest the importance of empowering team leaders and team members through enhancing elements of discretion, responsibility, clear role definition, collaborative interdisciplinary deliberation, and perceived self-efficacy. The results also suggest the importance of genuine concern and respect for participating publics and effective inter-agency coordination.

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## 1. Introduction

In this paper we identify and discuss key elements linked to outcomes of National Environmental Policy Act (NEPA) planning processes in the U.S. Forest Service. These processes accompany most major land management decisions within this agency and others and have posed major challenges for many federal land management agencies, especially the Forest Service, with regard to public relations, delays in decision-making, legal challenges, and financial costs and technical difficulties associated with impacts analyses and their disclosure (Bear, 2003; Keele et al., 2006; Management Analysis, Inc., 2007; Stern and Mortimer, 2009; Tzoumis, 2007). These challenges mimic many of those associated with environmental planning of any sort, regardless of the organization or agency doing the planning, or the country in which the process takes place (Brugnach et al., 2011; Cashmore, 2004; Reed, 2008; Robson et al., 2010).

Like most natural resource management planning processes, Forest Service NEPA processes are team processes. In addition to

requiring federal agencies to disclose the likely impacts of proposed projects with the potential to significantly impact the human environment, NEPA requires that agencies use a “systematic, interdisciplinary approach” when assessing the effects of proposed federal actions. In the U.S. Forest Service and other federal agencies, NEPA is performed by interdisciplinary (ID) teams. These teams are usually made up of disciplinary experts (e.g. biologists, ecologists, recreation specialists) that work through a process that typically includes: developing the purpose and need for action, scoping, development of alternatives, effects analysis, public comment, and drafting a final environmental document. In the Forest Service, one disciplinary expert on the team typically serves as the team's internal leader, or the interdisciplinary team leader (IDTL). ID teams interact in multiple ways to develop alternatives to address the project's stated purpose and need, to perform and disclose scientific analyses, and to manage required public involvement and inter-agency engagement. The team and the IDTL are also subject to some external (to the team) supervisory control by an agency “line officer,” typically a district ranger or forest supervisor. Line officers make the final decisions regarding the proposed action and have broad discretion regarding their degree of involvement in other team processes (Stern et al., 2010a; Stern and Mortimer, 2009).

Our work is based on a representative sample of 489 Forest Service NEPA processes completed between January 1, 2007 and December 18, 2009. Using these data we provide preliminary

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answers to questions that have troubled the agency for over 20 years: what factors contribute to declining efficiency in NEPA (longer and more costly processes), difficulties in achieving agency goals, poor disclosure in NEPA documentation, and declining public trust in the agency? Through an examination of team inputs, processes, and emergent states, this study focuses on uncovering elements of the NEPA processes that most strongly predict process outcomes. In particular, we focus on IDTLs' perceptions of the achievement of agency goals, NEPA compliance, efficiency, public relations, and team morale.

## 2. Literature review: exploring the drivers of team process outcomes

Research on team effectiveness has traditionally been based on an input–process–outcome (IPO) framework from the field of organizational psychology (Ilgen et al., 2005; Mathieu et al., 2008; McGrath, 1964). Inputs describe antecedent factors, such as the characteristics of individual team members, the team's preliminary stated goal(s) (in the Forest Service case, this is formally termed the "purpose and need" for the process), and the environmental or organizational context in which the team is created (Mathieu et al., 2008). These inputs are hypothesized to influence, at least to some degree, team processes, which describe how team tasks are performed. In the classical IPO model, processes mediate the relationship between inputs and outcomes. That is, inputs influence processes, which, in turn, influence outcomes (Mathieu et al., 2008). The implied linear nature of the classical model has drawn various critiques (Ilgen et al., 2005; Mathieu et al., 2006). Ilgen et al. (2005) point out the non-linear nature of the relationships between variables associated with teams and suggest an inputs–moderator–outcomes–inputs model that incorporates feedbacks and cyclical variables. Numerous researchers also point out the importance of emergent states brought on by the interaction between variables. These emergent states, for example, team empowerment or intra-team trust, may often drive outcomes more powerfully than any particular input or process variable (Ilgen et al., 2005; Marks et al., 2001; Mathieu et al., 2006). Teams are also influenced by multiple external factors, ranging from political context to relationships with multiple stakeholders; relationships between internal and external team leaders have been considered particularly important (Mathieu et al., 2006; Menon, 2001). Internal team leaders are those directly engaged in the process; in the Forest Service case, these are the IDTLs. External leaders typically serve as supervisors to whom the team leaders report; in the Forest Service case, these are typically line officers that serve as decision makers. These line officers, however, sometimes designate staff officers or others as intermediaries to serve as the team's immediate supervisors.

We take a holistic approach to this study by examining the relationships between inputs, processes, emergent states, and perceived outcomes along multiple dimensions of planning processes' life cycles within the U.S. Forest Service. We examine both internal and external elements influencing planning processes in the Forest Service, with a particular emphasis on emergent states. This approach is not without precedent (Dirks, 1999; Mathieu et al., 2008; Simons and Peterson, 2000), and we feel it particularly important in examining diverse cases in which inputs and processes are likely to be difficult to distinguish from one another and/or define consistently.

Much team research, including this study, relies on the self-reported understandings of team members to identify the key variables within the study (Stern et al., 2009; Wright, 2007). We acknowledge that perceptions themselves may often be emergent states, and distinguishing between any directly observable

condition and perception of that condition can be difficult (Marks et al., 2001). Furthermore, whether a team condition was pre-existing (an input) or a product of context and process (an emergent state) may frequently be blurry (Ilgen et al., 2005). Numerous studies, for example, have revealed disagreement about team goals, which may commonly be considered an input in the traditional IPO model (Simons and Peterson, 2000; Stern et al., 2009). This disagreement itself and its implications may also be considered emergent states that may be predictive of outcomes. While we developed variables with a focus on these states, we consider their explicit labeling as inputs, processes, or emergent states to be less important than their relationships to outcomes and each other.

### 2.1. Examining interdisciplinary teams in the U.S. Forest Service

Key team inputs considered in this study include the clarity of the purpose and need of the project, the prior experience and leadership styles of the IDTL, as well as their beliefs regarding the role of public involvement, and project context. Key processes include communications between the decision maker and the IDTL, turnover (personnel changes during the process) at multiple levels, ID team work styles, inter-agency coordination, and the use of external contractors. Key emergent states involve relationships and disagreement within the ID team and with the decision maker, feelings of empowerment of the IDTL, specific pressures felt by the IDTL, the degree of public influence throughout the process, the timing of when the preferred alternative became apparent, and perceptions of the quality of the science used in the process overall. Each of these items has been identified in prior research as potentially important to predicting outcomes of Forest Service NEPA processes (Stern and Mortimer, 2009; Stern et al., 2009, 2010b). Yet, no published study has empirically examined their influence on outcomes across a large sample of NEPA processes.

In addition to exploring the specific leadership styles of the internal team leaders (IDTLs), we also explicitly examine the degree to which the team leader felt empowered to be the team's clear leader. Empowerment is a central concept in the teams literature (Mathieu et al., 2006) and may be particularly relevant in a hierarchical organization like the Forest Service (Wilson, 1989), where the amount of discretion granted to field-level employees has been a topic of considerable focus (Mason, 2008; Sabatier et al., 1995; Stern and Mortimer, 2009; Stern et al., 2010a, 2010b). The role of external leaders has been recognized in the broader literature on teams to influence the degree of empowerment of their subordinate teams (Druskat and Wheeler, 2003; Hackman, 1990). We paid particular attention to IDTL and decision maker interactions because prior research on the agency has suggested that these relationships are crucial to Forest Service processes as well, particularly with regard to influencing IDTL feelings of empowerment (Stern and Mortimer, 2009; Stern et al., 2010b).

Work style variables collectively examine three dimensions of team processes, identified by Marks et al. (2001): (1) transition processes, in which team members engage in planning, strategizing, and goal-setting; (2) action processes, in which team members' interactions are focused on accomplishing tasks, coordinating actions, and monitoring team progress; and (3) interpersonal processes, in which team members manage conflicts, motivations, and emotional factors. Freeman et al. (2011) demonstrated wide variability in ID team work styles in the Forest Service; within a sample of only ten NEPA projects, some teams functioned in a primarily collaborative manner, openly deliberating issues across disciplines in their team settings. Other teams divided tasks

almost entirely, only coming together for status updates. Still other teams vacillated between these two extremes through the life of the project. Although the authors did not advance an argument about which work style is most effective, agency employees commonly view collaboration among ID team members as a key contributor to NEPA success (Stern et al., 2010b). We examine these issues by asking about work styles and team disagreement at multiple stages throughout the NEPA process to reflect transitional, action, and interpersonal elements of team processes.

Public involvement has also been regularly hypothesized to play a powerful role in NEPA process outcomes (Davenport et al., 2007; Leach, 2006; Predmore et al., 2011a; Scardina et al., 2007). While the participating public is typically interested in influencing agency decision-making, NEPA guidance directs agency personnel to focus on “substantive” comments and allows them to disregard comments that are conjectural or opinion-based in nature (Predmore et al., 2011b). Discretion in this sense lies with the agency personnel tasked with carrying out the process. As such, the values of agency personnel may be critically important drivers of the nature of public involvement in a NEPA process and associated outcomes (Yang and Callahan, 2007; Predmore et al., 2011a). We examine both the perceived degree of public influence over different aspects of each process as well as the beliefs of the team leader regarding the appropriate role(s) of public involvement. We also examine the influence of the timing of when the preferred alternative became clear on the project. If the preferred course of action was clear prior to initiating public involvement, it may be assumed that the public played a limited role during the process and in influencing decision-making.

We examine relationships between the inputs, processes, and emergent states described above and four outcome measures identified by Stern and Predmore (2011): comparative efficiency of the process, the simultaneous achievement of agency mission and compliance with NEPA, processes’ impacts on public relations, and their impacts on team members (Table 1). We also examine relationships between key independent variables to explore the full suite of characteristics associated most strongly with positive outcomes and make recommendations for potential revisions to agency team processes.

**Table 1**  
Outcomes variables (Stern and Predmore, 2011).

Outcomes	Mean
<b>Comparative efficiency (single item)</b>	3.23
• Compared to other NEPA processes I have been involved with, this process was efficient	
<b>Integrated Agency and NEPA Goals (index):</b> Cronbach's alpha = 0.786	4.20
• The final decision met the original purpose and need of the project	4.41
• The final decision reflects the mission of the agency	4.25
• The process resulted in a well-documented rationale for the final decision	4.14
• Full disclosure of potential impacts was achieved	4.22
• The final decision minimized adverse environmental impacts	4.28
• The final decision minimized adverse socioeconomic impacts	3.89
<b>Public Relations (index):</b> Cronbach's alpha = 0.818	3.63
• Public participants were satisfied with the final decision	3.56
• Public participants were satisfied with the process	3.66
• The process improved relationships between the agency and public participants in the process	3.29
• The process damaged relationships between the agency and participants in the process (inverse used in index)	2.01
<b>Team outcomes (index):</b> Cronbach's alpha = 0.805	3.93
• The process negatively affected team members' ability/desire to work together on subsequent projects (inverse used in index)	2.26
• Morale of the ID team was negatively affected by the process (inverse used in index)	1.88

### 3. Methods

#### 3.1. Sampling

Results are derived from an online survey of 489 different IDTLs of 489 different NEPA projects. The sample distribution across administrative regions, project type, and Environmental Impact Statements (EISs) versus Environmental Assessments (EAs), reflects the diversity of the overall population of 1724 NEPA processes completed during the time period of the study (see Stern and Predmore, 2011). By contacting the “project managers” of all 1724 NEPA processes completed between January 1, 2007 and December 18, 2009 listed in the U.S. Forest Service Planning, Appeals, and Litigation (PALS) database, we were able to identify 653 unique IDTLs that were responsible for 993 separate NEPA processes. To avoid having multiple surveys filled out by the same person, we limited the sample using set criteria. When a choice had to be made concerning which NEPA process should be surveyed for a given IDTL who served on more than one team, we gave first preference to EISs over EAs, because the former were rarer in our sample. Second, we selected the project that was most recently completed. After selecting NEPA processes using these criteria, our sample consisted of 653 NEPA processes (436 EAs) that were led by 653 different IDTLs. The response rate among IDTLs was 75%. For further details on sampling see Stern and Predmore (2011).

#### 3.2. Measurement

Table 1 shares the individual survey items making up the dependent variables of this study. An earlier publication describes the development of the dependent variables in greater detail (Stern and Predmore, 2011). *Comparative efficiency* was measured by a single survey item. The other outcomes are indexes based on the results of exploratory factor analysis (EFA), which is commonly used to group individual items that collectively reflect an underlying latent factor (see DeVellis, 2003). *Integrated agency and NEPA goals* captures team leaders’ perceptions about the degree to which the project’s final decision reflects the mission of the agency, meets the original purpose and need, and accomplishes tasks associated with NEPA, including minimizing adverse environmental and socioeconomic impacts and disclosing potential impacts. *Public relations* reflects the extent to which respondents felt the public was satisfied with the process and its outcome and associated impacts on agency–public relations. *Team outcomes* include perceptions of the impacts of the process on team morale and willingness to work together in the future. We also calculated a combined outcome measure by taking the mean of all four of the other outcomes (Cronbach’s  $\alpha = 0.681$ ).

Independent variables include team inputs, processes, and emergent states hypothesized to influence outcomes. Some survey items were combined into indexes that reflect latent constructs associated with important emergent states (Tables 2 and 3). In each case, the items were equally weighted and summed to create the index. We used exploratory factor analysis (principal components extraction and varimax rotation) to reduce multiple survey items into these latent factors, using procedures described in DeVellis (2003). Cronbach’s alpha scores, which are measures of internal consistency of the latent factors, are provided for each in Table 2. Scores above 0.6 are considered to reflect acceptable levels of internal consistency for use as latent variables, though higher scores are preferred (Gay, 1991).

Eleven indexes were created based on IDTL survey responses. The first index involves the nature of communication between the decision maker and the ID team. Two additional items relevant to this relationship were also recorded, but not included in the index: “The decision maker exhibited a clear understanding of the NEPA

**Table 2**  
Indexes developed through exploratory factor analyses.

Index name	Survey items
Clear communication by decision maker ( $\alpha = 0.877$ )	5 – point scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree <ul style="list-style-type: none"> <li>The decision maker's expectations were clearly articulated and understood throughout the process</li> <li>The decision maker's expectations were consistent throughout the process</li> <li>The decision maker made clear the criteria he/she intended to use for making the final decision</li> </ul>
Team disagreement ( $\alpha = 0.831$ )	How much disagreement was there between ID team members regarding each of the following items? (1 = no disagreement, 2 = very little, 3 = some, 4 = a moderate amount, 5 = a great deal) <ul style="list-style-type: none"> <li>The purpose and need</li> <li>The proposed alternatives</li> <li>The preferred alternative</li> <li>How to accomplish ID team tasks</li> <li>The approach that was taken for public involvement</li> <li>Interpersonal disagreements, not necessarily related to the task at hand</li> </ul>
Directive leadership style ( $\alpha = 0.705$ )	5 – point scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree <ul style="list-style-type: none"> <li>I set clear goals for the team</li> <li>I established clear standards for team members' performance</li> <li>I established clear deadlines for the team</li> </ul>
Empowering leadership style ( $\alpha = 0.728$ )	5 – point scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree <ul style="list-style-type: none"> <li>I worked collaboratively with team members to develop goals for the process</li> <li>I worked collaboratively with team members to develop agreed upon procedures for getting work done</li> <li>I encouraged team members to share their own solutions to problems</li> </ul>
Supportive leadership style ( $\alpha = 0.611$ )	5 – point scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree <ul style="list-style-type: none"> <li>I made an explicit effort to show my appreciation for team members' work</li> <li>I made an explicit effort to try to reduce time and task burdens on team members associated with the process</li> <li>I went out of my way to try to create a friendly team work environment for team members</li> </ul>
External accountability ( $\alpha = 0.843$ )	Please rate the intensity with which you felt each of the following pressures during this particular NEPA process (5 point scale: 1 = not at all; 2 = slightly; 3 = moderately; 4 = strongly; 5 = very strongly): <ul style="list-style-type: none"> <li>Pressure to ensure that the process was responsive to public input</li> <li>Pressure to maintain the agency's credibility with the public</li> <li>Pressure to maintain the agency's credibility with other agencies</li> <li>Pressure to maintain the agency's scientific credibility</li> </ul>
Upward accountability ( $\alpha = 0.720$ )	Please rate the intensity with which you felt each of the following pressures during this particular NEPA process (5 point scale: 1 = not at all; 2 = slightly; 3 = moderately; 4 = strongly; 5 = very strongly): <ul style="list-style-type: none"> <li>Pressure to meet pre-determined targets</li> <li>Pressure to meet the specific demands of the decision maker</li> <li>Pressure to complete the NEPA process in a timely manner</li> </ul>
Inward accountability ( $\alpha = 0.613$ )	Please rate the intensity with which you felt each of the following pressures during this particular NEPA process (5 point scale: 1 = not at all; 2 = slightly; 3 = moderately; 4 = strongly; 5 = very strongly): <ul style="list-style-type: none"> <li>Pressure to meet ID team members' standards for scientific rigor</li> <li>Pressure to communicate the consensus opinion(s) of the ID team to the decision maker</li> </ul>
Public influence ( $\alpha = 0.678$ )	For each NEPA-related task below, please share your personal opinions concerning the relative degree of influence of each entity (the Forest Service and the public) in carrying out the task. (1 = entirely Forest Service; 2 = mostly Forest Service; 3 = equal influence; 4 = mostly public; 5 = entirely public) <ul style="list-style-type: none"> <li>Developing the purpose and need</li> <li>Issues identification</li> <li>Alternatives development</li> <li>Analysis</li> <li>Final decision</li> </ul>
IDTL's belief in substantive public involvement ( $\alpha = 0.664$ )	5 point: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree <ul style="list-style-type: none"> <li>Public involvement should aim to ensure that public knowledge is incorporated into agency decisions</li> <li>Public involvement should focus on soliciting comments that improve the analysis of potential impacts</li> <li>Public involvement should help the public better understand our rationale for management actions</li> <li>Comments from the public that reflect points of fact are particularly valuable to the NEPA process</li> </ul>
IDTL's belief in normative public involvement ( $\alpha = 0.678$ )	5 point: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree <ul style="list-style-type: none"> <li>Comments from the public that reflect values and opinions are particularly valuable to the NEPA process</li> <li>Public involvement should aim to help the agency understand the preferences of the public</li> <li>Public involvement should aim to ensure that public values are incorporated into agency decisions</li> </ul>

**Table 3**  
Differences in perceived outcomes between simple and challenging NEPA processes.

Outcome	Context	Means	t-statistic	P-value
Achievement of integrated agency and NEPA goals	Simple	4.37	3.6	<0.001
	Challenging	4.16		
Efficiency	Simple	3.43	2.0	0.043
	Challenging	3.19		
Public relations	Simple	3.94	5.0	<0.001
	Challenging	3.56		
Team outcomes	Simple	4.40	5.4	<0.001
	Challenging	3.83		

process” and “The decision maker prioritized this process on the forest/district.” Exploratory factor analysis and reliability analyses showed these items to reflect distinct concepts.

The team disagreement index reflects the extent to which ID team members disagreed with each other throughout the process. While the literature suggests that disagreement about tasks and other project elements can be healthy for teams (Amason, 1996; Fisher and Ellis, 1990; Putnam, 1994; Simons and Peterson, 2000), this index, based on the response patterns of IDTLs, more specifically appears to measure what might be considered unhealthy disagreement, as interpersonal conflict co-varied directly with the other measures in the index.

Positive forms of disagreement, or those associated with collaborative deliberation, were measured by a separate battery of



survey items regarding team work styles. Team leaders were asked to indicate any stages of the process within which “the team worked together, collaborating across areas of expertise and openly deliberating most aspects of the project as a group.” These items were coded as binary variables, with a 1 indicating stages in the process during which this work style was dominant and a zero indicating a less collaborative style. Stages considered were the development of the purpose and need, scoping, alternatives development, analyses, writing/editing, developing public involvement strategies, and response to public comments.

In prior research involving the Forest Service, we have observed three common leadership styles: directive, empowering, and supportive (Freeman et al., 2011; Stern and Mortimer, 2009). Directive team leaders set clear goals for their teams and provide detailed guidance for how to get the work done, often relying on their position of power to promote work efficiency (Pearce and Sims, 2002). Empowering leadership involves the devolution of power to team members and their engagement in cooperative goal-setting, which tends to catalyze greater team cooperation (Pearce and Sims, 2002; Sarin and O'Connor, 2009; Waugh and Streib, 2006). Supportive leaders express concern for the needs and preferences of team members when making decisions (Rafferty and Griffin, 2006). Supportive leadership thus involves creating a worker-friendly environment by developing both an appreciative and protective work environment. In the Forest Service case, this typically includes working to minimize workload burdens on ID team members (Stern and Mortimer, 2009; Stern et al., 2010b). These leadership styles were measured in this study through self-reported behaviors rather than philosophical approaches; as such, they are not mutually exclusive.

IDTLs may also feel different forms of accountability to different entities, which may influence their actions throughout the NEPA process (Stern et al., 2010a). *External accountability* reflects pressure to maintain credibility with entities outside the agency. *Upward accountability* reflects pressure to meet the demands of the team's external leader, the decision maker. Prior research shows a tendency for decision makers in the Forest Service to focus on process efficiency and meeting targets (Stern et al., 2010a, 2010b). *Inward accountability* reflects pressure to defer to members of the ID team. An additional accountability measured but not included in an index included IDTLs' feeling of pressure to ensure that the process and documentation were legally defensible, a pressure well-documented in the literature (e.g., Mortimer et al., 2011; USDA Forest Service, 2002). Exploratory factor analysis and reliability analysis showed this variable to reflect a distinct concept.

The *public influence* index measured team leaders' perceptions about the degree to which the public had influence over decisions made throughout the process. Individual scores for each stage of the process, ranging from 1 (no public influence) to 5 (public made decision), were equally weighted and summed to create the index.

IDTLs' beliefs about public involvement were categorized into three primary points of view. *Substantive public involvement* most closely reflects agency guidance that public comments should be “substantive,” or focused on incorporating points of fact from the public into agency analyses. Meanwhile, *normative public involvement* focuses on incorporating values, opinions, and preferences of the public into agency decision-making. A single item represented a third point of view – the extent to which IDTLs agreed or disagreed with the following statement: “Public involvement is a procedural requirement that rarely contributes meaningfully to making better land management decisions.”

Other independent variables included team leaders' perceptions about the quality of science achieved in their process, the clarity of the purpose and need, the quality of inter-agency engagement, turnover of personnel, whether the team leader felt empowered to be the team's clear leader, whether compromise took place within

the ID team and with other stakeholders, the use of external contractors, prior experience and training of the IDTL, and when the preferred alternative became apparent in the process.

### 3.3. Analysis

Prior to analysis, we split the sample into two subsamples, challenging and simple projects, using IDTLs' perceptions of the expected level of controversy, complexity, and uncertainty associated with each project, each rated on a 3-point scale (low, moderate, high). Simple projects ( $n = 83$ ) had low levels of each of these elements of process risk (see MacGregor and Seesholtz, 2008). Challenging projects ( $n = 405$ ) had at least moderate levels of at least one of these elements. We split the sample because prior research suggests that “simple” NEPA processes may be different phenomena altogether (Stern and Mortimer, 2009; Stern and Predmore, 2011). If there is no uncertainty, controversy, or complexity, it is likely that the predictors of process outcomes may be different than for those of a more challenging nature.

All independent variables were examined for correlations with the dependent variables and then entered into multiple stepwise regression models to determine which best predicted process outcomes. We then examined correlations between key independent variables to explore which variables may be serving as mediators, or emergent states, and which may be antecedent variables that produce those states. Mediation occurs when one variable accounts for the relationship between two other variables. Mediation can be detected when a significant relationship between an independent (antecedent) variable and a dependent (outcome) variable is reduced or eliminated when another variable, the mediator, is introduced (Baron and Kenny, 1986). For example, clearer communications with between the IDTL and decision maker may be correlated with the achievement of integrated agency and NEPA goals. However, when considered in stepwise regression, feelings of empowerment of the IDTL might reduce the predictive power of the communications variable (rendering it insignificant in the regression equation). This would suggest that feelings of empowerment are mediating the effect of clearer IDTL/decision maker communications on the outcome variable. In other words, clearer IDTL/decision maker communications enhance the outcome by increasing feelings of empowerment of the IDTL.

## 4. Results

Table 3 shows a comparison of outcomes between challenging and simple projects, supporting our hypothesis that these processes may be inherently different, with simple projects showing significantly more positive results for each outcome of interest. Table 4 displays bivariate correlations between each of the independent variables and IDTLs' perceptions of process outcomes. To ease communication and interpretation, only statistically significant ( $p \leq 0.05$ ) correlation coefficients are displayed. As one might expect, outcomes of challenging processes are related to far more elements of the NEPA process than simple processes. That is, more seems to matter when predicting outcomes of these processes. With few exceptions, the process elements that are related to outcomes in simple projects are subsets of those related to outcomes in challenging projects. The process elements most consistently related to all four outcomes measured in challenging contexts include: a clear purpose and need, the use of best available biophysical and social science, an IDTL who felt empowered to be the team's clear leader (regardless of their leadership style), clear communication between the decision maker and the ID team, and lesser disagreement among ID team members. No process elements consistently predicted all four outcomes for simple processes.

**Table 4**

Pearson correlations of IDTL perceptions for challenging and simple projects.

Independent variables	Integrated agency and NEPA goals		Efficiency		Public relations		Team outcomes	
	Challenging	Simple	Challenging	Simple	Challenging	Simple	Challenging	Simple
The project had a clear and unambiguous purpose and need.	0.481**	0.646**	0.215**	–	0.207**	–	0.189**	–
The process employed best available biophysical science.	0.595**	0.589**	0.209**	–	0.223**	0.304**	0.258**	0.224**
The process employed best available social science.	0.435**	0.349**	0.163**	–	0.164**	–	0.205**	–
I felt empowered on this project to be its clear leader.	0.354**	0.343**	0.352**	0.285**	0.277**	0.224**	0.404**	0.386**
Empowering leadership style of IDTL.	0.309**	–	0.228**	–	0.254**	–	0.265**	–
Directive leadership style of IDTL.	0.265**	–	0.156**	–	–	–	0.194**	–
Supporting leadership style of IDTL.	0.167**	0.310**	0.255**	–	–	–	0.109*	–
Clear communication between the decision maker and the ID team.	0.228**	0.255*	0.216**	–	0.108*	–	0.258**	0.300**
The decision maker exhibited a clear understanding of the NEPA process.	0.173**	0.276*	–	–	0.116*	–	0.122*	0.263*
The decision maker prioritized this process on the forest/district.	–	–	0.159**	–	–	–	0.163**	0.255*
Other agencies were effectively engaged.	0.248**	–	–	–	0.164**	–	0.201**	–
The amount of disagreement among ID team members.	–0.357**	–0.324**	–0.232**	–	–0.269**	–	–0.458**	–0.401**
Turnover of the IDTL	–0.123*	–	–0.130*	–	–0.122*	–	–0.159*	–0.292**
Turnover of ID team members	–	–	–0.232**	–	–0.166**	–	–0.218**	–
Turnover of the decision maker	–	–	–0.120*	–	–	–	–0.169**	–
Interdisciplinary collaborative teamwork... when developing the purpose and need.	0.177**	–	0.106*	–	0.169**	–	0.162**	–
during scoping.	–	–	–	–	–	–	–	–
when developing alternatives.	0.143**	–	0.134**	–	–	–	0.100*	0.225*
during analyses.	–	–	–	–	–	–	–	–
while writing the document.	–	–	0.141**	–	–	–	–	–
developing public involvement strategies.	–	–	0.160**	–	0.125**	–	0.192**	–
responding to public comments.	–	–	0.218**	–	–	–	0.112*	–
IDTLs' belief in...								
public involvement as a requirement that rarely contributes to a better decision	–0.138**	–	–0.159**	–	–	–0.254*	–0.229**	–0.287*
substantive public involvement	0.208**	0.264*	0.107*	–	–	–	0.132**	–
normative public involvement	0.147**	–	–	–	–	–	–	0.233*
The degree of public influence throughout the process.	–	–	–	–	0.113*	–	–	–
Compromise took place between the Forest Service and other interested parties.	–	–	–	–	0.140**	–	–	–
Accountabilities: degree of pressure felt by IDTL to...								
maintain the agency's credibility externally	0.176**	–	0.160**	–	0.128*	0.243**	0.154**	–
meet the demands of the decision maker	–0.128*	–	–	–	–0.115*	–	–0.191**	–
defer to the ID team's expertise/opinions	–	–	0.130*	–	–	–	–	–
Degree of NEPA-related training	0.105*	–	–	–	–	–	–	–
Prior experience of the ID team as an ID team member.	–	–	–	–	0.113*	–	0.114*	–

Factors with no significant correlation with any outcome: Prior experience of the IDTL as an IDTL, compromise took place within the ID team, use of external contractors, timing of when the preferred alternative became clear.

\*Significant at the 0.05 error level.

\*\*Significant at the 0.01 error level.

–Not significant at the 0.05 error level.

Table 5 displays the results of stepwise regression analyses on each of the outcome metrics for both challenging and simple projects. Two factors dominated the regression models predicting all outcomes in challenging contexts. A lack of team harmony was negatively associated with all outcomes, while team leader empowerment was a positive predictor of all outcomes.

Best prediction was achieved for integrated agency and NEPA goals with the models explaining approximately 54% of variance in the outcome for challenging projects and nearly 60% for simple projects. For integrated agency and NEPA goals, perceptions that the process employed the best available biophysical science and had a clear and unambiguous purpose and need were paramount in both challenging and simple processes. Intra-team disagreement was associated with lesser achievement in challenging projects, while perceptions about the empowerment of the team leader, the decision maker's understanding of the NEPA process, the IDTLs' belief in substantive public involvement, and effective inter-agency engagement all contributed positively to the achievement of agency and

NEPA goals. In simple projects, the only additional significant predictor in the model was an inverse relationship between goal achievement and IDTLs' beliefs that that public involvement is merely a procedural requirement. The models suggest that clear problem definition, effective science, team harmony, empowered and effective leadership, and a genuine belief in external stakeholder involvement most strongly contribute to meeting these goals.

Process efficiency on challenging processes was best predicted by the empowerment of the team's leader to be its clear leader, a clear and unambiguous purpose and need, disagreement between ID team members (inversely related to efficiency), a supportive leadership style of the IDTL, turnover on the ID team (inversely related to efficiency), interdisciplinary collaborative teamwork while responding to public comments, and the degree of pressure felt by the IDTL to defer to ID team expertise. The model suggests that efficiency is positively influenced by clarity of the task at hand, clear role definition and deference to expertise, and effective leadership and collaboration on the ID team. On simple projects,

**Table 5**  
Regression models on outcomes in challenging and simple contexts.

Independent variables	Integrated agency and NEPA goals		Efficiency		Public relations		Team outcomes		Combined outcome	
	Standardized $\beta$		Standardized $\beta$		Standardized $\beta$		Standardized $\beta$		Standardized $\beta$	
	Challenging	Simple	Challenging	Simple	Challenging	Simple	Challenging	Simple	Challenging	Simple
The process employed the best available biophysical science	0.414**	0.399**	—	—	—	0.292**	—	—	0.123**	0.210**
The project had a clear and unambiguous purpose and need	0.266**	0.499**	0.131**	—	—	—	—	—	0.138**	—
Amount of disagreement between ID team members	−0.160**	—	−0.135**	—	−0.198**	—	−0.377**	−0.405**	−0.289**	−0.209**
I felt empowered on this project to be its clear leader	0.123**	—	0.205**	0.285*	0.145**	—	0.206**	0.246*	0.250**	0.344**
Decision maker exhibited a clear understanding of the NEPA process	0.108**	—	—	—	—	—	—	—	—	—
IDTLs' belief in substantive public involvement	0.102**	—	—	—	—	—	—	—	—	—
Other agencies were effectively engaged.	0.093*	—	—	—	0.108*	—	0.133**	—	0.113**	—
IDTLs' belief that public involvement is merely a requirement	—	−0.171*	—	—	—	−0.240*	−0.166**	—	−0.105**	—
Interdisciplinary collaborative teamwork while responding to public comments	—	—	0.124**	—	—	—	—	—	—	—
Turnover on the ID team	—	—	−0.168**	—	—	—	—	—	−0.138**	—
Supportive leadership style of the IDTL	—	—	0.181**	—	—	—	—	—	—	—
Degree of pressure felt by the IDTL to defer to ID team expertise	—	—	0.099*	—	—	—	—	—	—	—
Empowering leadership style of the IDTL	—	—	—	—	0.154**	—	0.125**	—	0.154**	—
Preferred alternative did not become clear until after the draft document was completed	—	—	—	—	−0.148**	—	—	—	—	—
Interdisciplinary collaborative teamwork while developing the purpose and need	—	—	—	—	0.126*	—	—	—	—	—
Greater degree of public influence throughout the process	—	—	—	—	0.119*	—	—	—	—	—
Turnover of the IDTL	—	—	—	—	−0.094*	—	−0.084*	—	—	—
Turnover of the decision maker	—	—	—	—	—	—	−0.108*	—	—	—
Decision maker prioritized the process.	—	—	—	—	—	—	—	0.254*	—	—
$R^2$	0.539	0.591	0.257	0.081	0.209	0.150	0.385	0.322	0.483	0.279
$N$	379	78	386	82	354	78	362	81	363	80
Model $F$ -statistic	62.7	35.6	18.9	7.1	11.9	6.6	33.4	12.2	41.1	9.3
Model $p$ -value	<0.001	<0.001	<0.001	0.009	<0.001	0.002	<0.001	<0.001	<0.001	<0.001

\*Significant at the 0.05 error level.  
\*\*Significant at the 0.01 error level.  
Not significant at the 0.05 error level.

only one factor showed any significant association at all with process efficiency – a clearly empowered team leader.

Public relations outcomes were the least well predicted outcome by the regression analyses, with only 21% and 15% of the variance explained in challenging and simple projects, respectively. Team harmony, the clear empowerment of the team leader, an empowering team leadership style, effective inter-agency engagement, interdisciplinary collaborative teamwork while developing the purpose and need, greater public influence on the process, and a lack of turnover of the team leader were all associated with more positive public relations outcomes.

The timing of when the preferred alternative became clear also entered the regression equation on public relations as a suppressor variable. Suppression is a special case in regression when a predictor variable that is not directly correlated with the dependent variable (public relations, in this case) enters a regression equation as a result of its relationships with other predictor variables (Cohen and Cohen, 1975). Further analyses revealed that in this case the suppressor variable is explaining a portion of the error variance of two other variables in the question: interdisciplinary

collaborative teamwork while developing the purpose and need and the degree of public influence throughout the process. When the suppressor variable is removed from the equation, the predictive ability of both is reduced. As such, we can interpret the suppression to mean that in cases where the preferred alternative does not become apparent to the IDTL until after the drafting of the environmental document, the predictive ability of these two variables is enhanced. In other words, interdisciplinary collaborative teamwork and a greater degree of public influence become more important to public relations outcomes in these situations.

Team outcomes were best predicted by the amount of disagreement between ID team members and whether the team leader felt empowered to be the team's clear leader. Prioritization of the process by the decision maker was also particularly important to team success on simple projects. Other positive predictors of team outcomes on challenging projects included effective inter-agency engagement and an empowering leadership style of the team leader. Turnover of the IDTL and decision maker, as well as team leaders' beliefs that public involvement is merely a requirement, also negatively impacted team outcomes.

When combining all outcomes of interest into a single index, the best predictors of better outcomes in a challenging context include: an empowered team leader, team harmony, an empowering leadership style of the IDTL, a lack of turnover on the ID team, a clear and unambiguous purpose and need, best available science, effective inter-agency engagement, and a non-dismissive attitude of the IDTL toward public involvement. These variables explained nearly half the variance in the combined outcome. In simple projects, the most powerful predictors were an empowered team leader, best available science, and team harmony, explaining about 28% of the variance in the combined outcome.

We also examined the inter-relationships between those elements most predictive of process outcomes, specifically perceptions of a clear and unambiguous purpose and need, a clearly empowered team leader, the employment of best available biophysical science, the level of intra-team disagreement, and effective inter-agency coordination for the entire sample, including both simple and challenging projects (Table 6). These variables were also examined in relationship to other variables correlated with outcomes to test for mediation effects. Significant correlations with variables not included in the regression equations would indicate that the predictors within the regression equations may be serving, at least to some extent, in a mediating role.

The correlation matrix (Table 6) reveals that the elements that are most predictive of process outcomes have a tendency to coincide and that certain other independent variables are strongly correlated with those primary predictors. A clear and unambiguous purpose and need showed strongest associations with best available science, lower levels of team disagreement, a clearly

empowered team leader, stronger leadership behavior (regardless of specific styles), and clear communication with the decision maker. Team leaders tended to feel most empowered when they had more prior training and NEPA experience, there was clear communication with the decision maker, and the decision maker prioritized the process. Team leader empowerment was also associated with higher degrees of collaborative deliberation on the ID team, lower levels of team disagreement, greater achievement of best science, and greater commitment to public involvement. More positive opinions of the science employed in processes were also associated with more collaborative deliberation on the ID team and an empowering leadership style of the team leader. Team disagreement was associated with higher degrees of upward and inward accountabilities and a lack of clear communication by the decision maker. In general, outward accountability was positively associated with positive predictors of outcomes, while upward accountability was typically negatively associated. The implications of these relationships are discussed below.

## 5. Discussion

NEPA processes are complex interactions involving multiple entities with competing accountabilities, responsibilities, roles, interests, and demands. This study focuses on the perceptions of individuals holding one role within these processes, the IDTL. Prior research suggests that these individuals are the most heavily involved in all aspects of these processes (Stern and Mortimer, 2009; Stern et al., 2009). However, prior studies also suggest that these individuals tend to see these processes and their outcomes

**Table 6**  
Pearson correlations between independent variables.

Related variables	Key predictors of process outcomes				
	Clear and unambiguous purpose and need	Clearly empowered leader	Best biophysical science	Level of team disagreement	Other agencies effectively engaged
Clearly empowered leader	0.175**				
Best biophysical science	0.323**	0.241**			
Level of team disagreement	−0.302**	−0.237**	−0.175**		
Other agencies effectively engaged	0.099*	0.121*	0.213**	—	
Best social science	0.260**	0.164**	0.486**	−0.218**	0.222**
Interdisciplinary collaboration during:					
Developing purpose and need	—	0.163**	0.178**	—	0.105*
Scoping	—	—	0.126**	—	—
Alternatives development	—	0.176**	0.175**	0.108*	0.154**
Analyses	—	—	—	—	0.100*
Writing	—	0.107*	—	—	—
Developing public involvement strategies	—	0.121*	0.130**	—	0.092*
Response to public comments	—	0.181**	0.100*	—	0.089*
Compromise took place within the ID team	—	—	—	0.194**	0.129**
Turnover on the ID team	—	−0.153**	—	0.194**	−0.102*
Turnover of the decision maker	—	—	—	0.133**	—
Clear communication by decision maker	0.166**	0.352**	0.116*	−0.221**	—
Decision maker had clear understanding of NEPA	—	0.243**	—	—	—
Decision maker prioritized project	—	0.278**	0.095*	—	0.090*
Prior experience of team leader on ID teams	—	0.245**	0.089*	—	—
Prior experience of team leader as IDTL	—	0.145**	—	—	—
NEPA training of IDTL	—	0.129**	0.109*	—	—
IDTL belief in substantive public involvement	—	0.155**	0.131**	—	—
IDTL belief in normative public involvement	—	—	0.139**	—	—
IDTL belief that public involvement is merely a requirement	—	−0.281**	−0.093*	—	—
Directive leadership style	0.147**	0.357**	0.205**	—	0.102*
Empowering leadership style	0.136**	0.186**	0.290**	−0.107*	0.133**
Supportive leadership style	—	0.196**	0.163**	—	—
Amount of public influence throughout project	—	—	—	0.119*	0.113*
Degree of outward pressure	0.106*	0.190**	0.190**	—	0.224**
Degree of upward pressure	−0.095*	−0.123**	—	0.222**	—
Degree of inward pressure	—	—	0.119**	0.189**	0.119**

\*Significant at the 0.05 error level.

\*\*Significant at the 0.01 error level.

—Correlation not significant at the 0.05 error level ( $p < 0.05$ ).



from a particular point of view not necessarily shared by others internal or external to the agency (Stern et al., 2010a, 2010b; Stern and Predmore, 2011). IDTLs typically express greater concerns than decision makers about minimizing negative environmental and socioeconomic impacts. They also tend to place greater emphasis on the importance of public relations and team outcomes and lesser emphasis on efficiency than decision makers (Stern and Predmore, 2011). IDTLs are often disciplinary specialists and can sometimes view their role as protectors of the resources they study (Stern et al., 2010a, 2010b). Being embroiled in the daily workings of the ID team, they not only tend view these processes and their outcomes through a different lens than decision makers, but they likely also have different views than members of the public, who typically express a wide diversity of opinion, expertise, and understanding. As such, the results should be interpreted as one version of the story – that seen from inside the agency by those most directly and completely engaged in the process.

IDTLs' perceptions of these processes and their outcomes suggest the critical importance of certain team inputs, processes, and emergent states in influencing desirable outcomes. While we did not pursue structural equations modeling due to limitations in our dataset, regression and correlation analyses provide some clues as to which of these variables may serve as mediating variables, or those that may account for the relationships observed between antecedent variables and outcomes, and which may serve as antecedent variables. Mapping these relationships provides insights into the key drivers of process outcomes and areas for the Forest Service and other natural resource management agencies and organizations to consider for enhancing those outcomes.

Multiple predictors emerged for different outcomes in regression equations. Results suggest first and foremost that projects that lack uncertainty, controversy, and complexity may be inherently different than those we have deemed as “challenging.” The best predictors of these, more “simple,” processes include the empowerment of the IDTL, team harmony, and the employment of best available science. These variables comprise a subset of the most important variables found in more challenging contexts. As such, we can infer that these particular variables appear to matter regardless of context. The most consistent predictors of more desirable outcomes in challenging processes included the empowerment of the IDTL and the amount of unhealthy disagreement among ID team members, followed by perceptions of a clear purpose and need and employing the best available science.

Empowerment of the team leader can be broken down into multiple elements. Mathieu et al. (2006) favor a two-dimensional conceptualization in which empowerment equates to authority and responsibility for team functioning. Others suggest elements of competence, self-determination (or freedom to choose how tasks are to be carried out), a sense that the work is important or meaningful, and a belief that the work will have an impact on the effectiveness of the larger system as important components of empowerment (Kirkman and Rosen, 1999; Spreitzer, 1996).

In the context of the Forest Service, each of these elements is likely to influence feelings of empowerment of disciplinary experts who find themselves in the role of IDTL (Stern et al., 2010b). More empowered team leaders in this study typically had higher degrees of training and prior experience, possibly reflecting a greater sense of self-efficacy or confidence. The relationship with the decision maker also appears critical to this sense of empowerment.

Empowered team leaders more commonly set clear goals for their team and worked in ways that would empower team members and create supportive environments. Empowered team leadership was also associated with more collaborative team deliberation and perceptions of better science and outcomes. Teams with higher degrees of interdisciplinary collaboration and deliberation not only

tended to produce better science according to IDTLs, but they were also more efficient. Elements of interdisciplinary collaboration were positively associated with all outcomes of the study. Collaborative teamwork was defined in the survey as working together, “collaborating across areas of expertise and openly deliberating most aspects of the project as a group.” This form of open and active deliberation has been linked to team cohesiveness and improved outcomes in other studies as well (Amason, 1996; Fisher and Ellis, 1990; Simons and Peterson, 2000). From this, we infer that empowered team members may be more likely to work in this style and therefore perform better on NEPA processes.

Additional important antecedent variables involved the engagement of external stakeholders. While the degree of public influence within the processes was not consistently associated with positive or negative outcomes, IDTLs' beliefs about the value of public involvement were. IDTLs who believed public involvement to be merely a requirement commonly reported less desirable project outcomes than those with a more genuine belief in the benefits of conducting public involvement. While public influence may result from positive relationships, antagonistic conflict, or neutral circumstances, disingenuous or insincere public involvement appears to consistently negatively influence process outcomes and other variables of importance (Innes and Booher, 2004; Predmore et al., 2011b; Reed, 2008). Similar to prior research, internal disagreement within the ID team was also strongly related to public relations problems, suggesting not only that external conflict can negatively impact intra-team relations, but also that internal conflict may bleed out into relationships with external stakeholders (Stern, 2010). The importance of effective inter-agency coordination was also reflected in regression on most outcomes in the study as well, again suggesting the importance of genuine interactions with external stakeholders.

While we have identified important predictors of process outcomes, many questions remain unanswered. These involve both the deeper meanings of some of the variables within the study and the directionality of effects of others. For example, how do respondents interpret the term “best available science?” What constitutes effective inter-agency coordination? Does an empowered team leader drive the degree of collaboration within an ID team or does a more collaborative group of ID team members lead to stronger feelings of empowerment of the IDTL? Other questions involve how to apply the results to improving NEPA processes. In particular, how can the agency nurture perceptions of self-efficacy and empowerment, a genuine concern for the public, and skills in facilitating interdisciplinary collaboration? Our findings coupled with the literature suggest that empowerment can be enhanced through training and adjustments to organizational structure that enhance feelings of competence, authority, self-determination, and a sense that the work has a real impact on agency decisions and resource management. This may involve elements of collaborative goal-setting, clear role definition, limiting turnover on teams, and linking procedural compliance more directly with decision-making (see Stern and Predmore, 2011). Inspiring a genuine concern for the public and facilitation skills may also be addressed through training and agency guidance. We urge the Forest Service and other federal land management agencies to consider these findings in designing future training for those involved in NEPA processes. We also urge future research to consider these unanswered questions and to pursue additional measures of process outcomes across project types and across varying contexts.

## 6. Conclusions

The study reveals the importance of numerous team elements (inputs, processes, and emergent states) in predicting the outcomes of NEPA processes in the U.S. Forest Service. The most powerful

cross-cutting predictors included a harmonious team atmosphere, a clearly empowered team leader who exhibits an empowering leadership style, a clear and unambiguous purpose and need, the employment of best available science, effective inter-agency engagement, IDTLs' genuine belief in the positive value of public involvement, and lesser turnover on ID teams. Numerous antecedent variables were associated with these primary predictors, including greater collaborative interdisciplinary deliberation within the ID team, clear communications with a decision maker who prioritizes the project, and stronger feelings of accountability to the public. We urge future research on the relationships between decision makers and IDTLs and other conditions which may catalyze or constrain the development of the factors found herein to lead to more desirable outcomes. We also urge future research on the relationships between team inputs, process, and emergent states that makes use of additional and external measures of process outcomes beyond the self-reported perceptions of team leaders.

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